FARM CREDIT ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

DELIVERY CONSERVATION PRACTICES OF COOPERATIVE OIL ASSOCIATIONS AFFILIATED WITH THE FARMERS UNION CENTRAL EXCHANGE

By

J. WARREN MATHER

COOPERATIVE RESEARCH AND SERVICE DIVISION

Miscellaneous Report No. 77

October 1944

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM CREDIT ADMINISTRATION

I. W. Duggan, Governor

Cooperative Research and Service Division

Harold Hedges, Acting Chief W. W. Fetrow, Associate Chief

- - * - -

CONTENTS

- - - -

Copies of this publication may be had
on request while a supply is available
from the
Director of Information and Extension
Farm Credit Administration
Kansas City 8, Missouri

DELIVERY CONSERVATION PRACTICES OF COOPERATIVE OIL ASSOCIATIONS AFFILIATED WITH THE FARMERS UNION CENTRAL EXCHANGE

By J. Warren Mather
Agricultural Economist

Power equipment is essential in farming a large part of the North Central States "food basket." It is imperative, therefore, that delivery service from bulk stations to farms be maintained to keep tractors and other motorized equipment supplied with fuel. In this distribution service, the ordinary tank truck is a necessary link.

Careful and efficient operation of tank trucks not only conserves manpower, gasoline, rubber, and other critical materials, but it means lower delivery expense per unit and, therefore, lower cost fuels to members of associations that own their tank trucks. To managers and servicemen or salesmen owning the trucks and employed on a commission basis, reduction in delivery expense means increased net income. In some cases, savings resulting from increased efficiency are passed on to both members and employees.

Realizing the necessity of conserving local delivery equipment during the war and the importance of efficient transportation service, the Farmers Union Central Exchange, St. Paul, Minnesota, requested the Cooperative Research and Service Division to make a study of delivery practices of farmers' petroleum cooperatives affiliated with the Exchange. Twenty-one representative local cooperative oil associations were selected for the survey. Their locations and approximate trade areas are shown in the map, figure 1. Approximately 1 day was spent at each association early in the summer of 1943 and additional data were obtained by mail.

The study was directed toward wartime delivery conservation practices that would be of immediate assistance and those which could be used by local cooperatives in developing delivery efficiency programs in the post-war period.

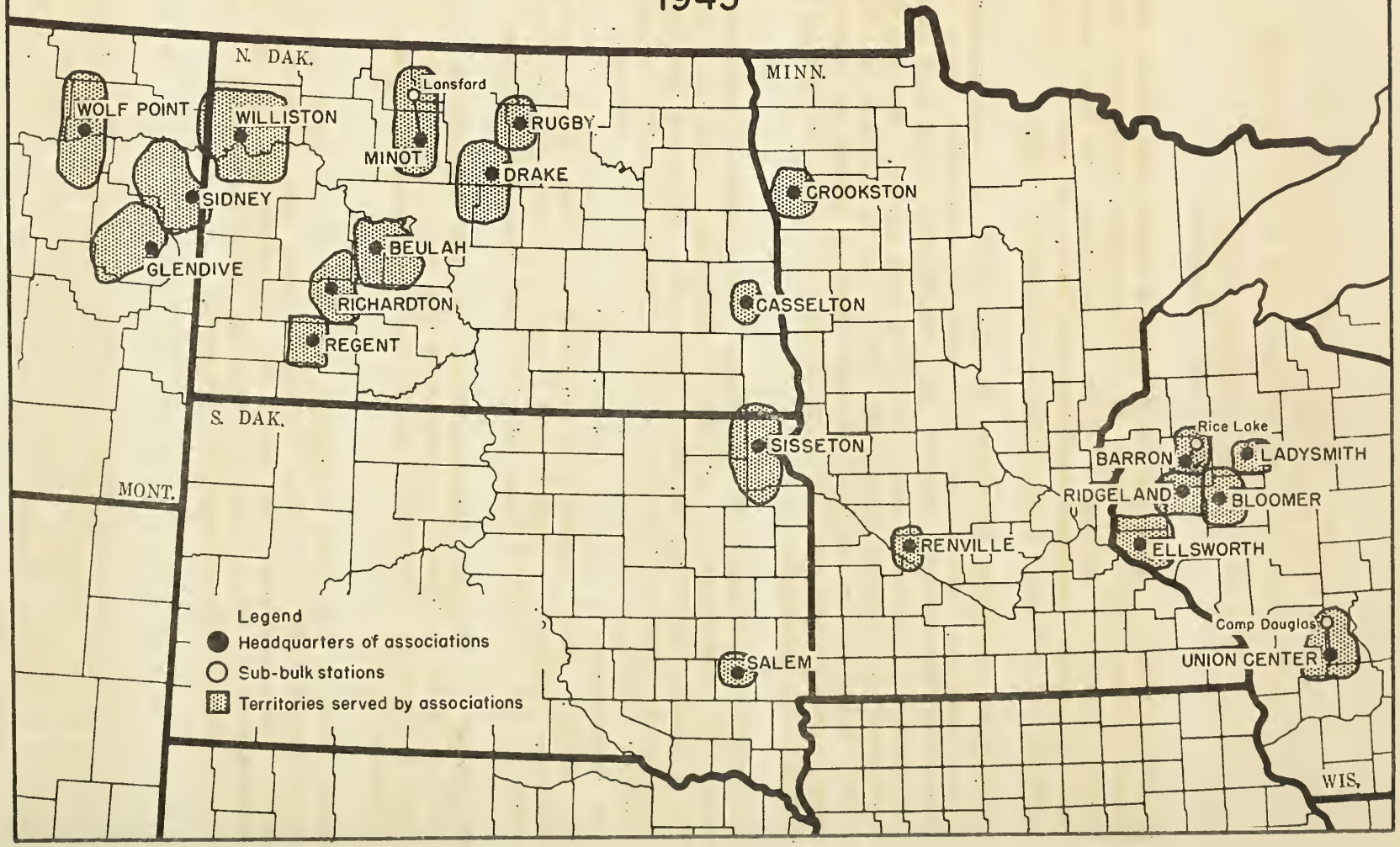
Limitations of data were recognized because of the small number of associations studied in this five-State area, the variations in systems and in the conditions under which they operated, and the lack in many cooperatives of truck operating cost and delivery records - especially pre-war records for comparative purposes.

NOTE: The author wishes to express appreciation to managers and other employees of the local cooperative oil associations visited for their cooperation in connection with this study. Acknowledgment of valuable suggestions and assistance is made to J. A. Nolan and Harold Burns, manager and assistant manager, respectively, of the Petroleum Department, Farmers Union Central Exchange; and to Joseph G. Knapp, Principal Agricultural Economist, Cooperative Research and Service Division, Farm Credit Administration.

FIGURE I

LOCATION OF COOPERATIVE OIL ASSOCIATIONS AND AREAS SERVED

1943



014321-1

CHARACTERISTICS OF THE ASSOCIATIONS STUDIED

Each of the 21 cooperatives studied was an incorporated association owned by local farmers. All were formed in the period 1929-41. Sales of petroleum products amounted to more than 70 percent of the 1942 sales of 18 associations, although the volume of accessories and miscellaneous farm supplies had increased greatly since 1937.

Eighty percent or more of the motor fuels handled by two-thirds of the cooperatives was delivered to farms. Two cooperatives distributed most of their farm volume on a "come and get it" basis through their pumps and dock stations. Three of the group each operated one or more outlying bulk stations. All but one operated a service station and three had one or more outlying service stations. Nine sold fuel to other dealers who operated curb pumps.

Some associations served only the immediate surrounding area; others served several communities or an entire county. Ten associations reported trade territories ranging from 360 to 999 square miles in area and 11 had territories of from 1,000 to 2,000 square miles. The average territory served per truck for 10 of the moderate-sized cooperatives ranged from 200 to 400 square miles.

A cooperative usually had three to five competing bulk plants in its immediate trade territory. Estimates by managers indicated that 11 cooperatives were handling one-third to one-half of the potential farm petroleum business in their trade territories and 6 were handling two-thirds or more.

Volume of business varied greatly among the group studied. Sales of light petroleum fuels ranged from 202,542 to 1,239,513 gallons per association in 1942; half of the organization handled between 300,000 and 600,000 gallons and the average volume was 531,627 gallons. Sales of all petroleum products averaged $89,792 per association.

Two-thirds of the cooperatives had between 200 and 850 members and between 300 and 1,200 patrons. All were crediting patronage refunds on the purchase price of an initial share of stock for each nonmember patron.

Most of the bulk plants had capacities ranging from 48,000 to 80,000 gallons and their costs (exclusive of land, offices, service stations, and trucks) ranged from $4,000 to $10,000.

General managers were employed as follows:

Basis of employment:	Number of managers
Straight commission	16
Straight salary	3
Combination salary and commission	1
Salary plus bonus	1

Twelve of the 17 commission-basis managers owned their tank trucks; 2 owned part of the trucks, with truck operators owning the others; and 3 did not own any trucks as they were owned by the truck operators. The prevailing rates of commission paid the managers owning trucks were 2 cents per gallon on regular gasoline, 1½ - 2 cents on kerosene, 1½ cents on distillate and other tractor fuel, 7 cents per gallon on oil, 1 - 1½ cents per pound on grease, and 50 percent of the gross margin realized on miscellaneous merchandise.

Six of the 17 commission-basis managers hired all their tank-truck operators on a commission basis; 9 hired them on a salary basis; and 2 hired some on each basis. Of the 4 associations employing managers on a salary, only 1 hired truck operators on a commission basis. Truck operators usually received commissions of 1½ cents per gallon on light fuels, 5 cents per gallon on oil, 1 cent per pound on grease, and 10 percent on merchandise. Their salaries in 1943 usually ranged from $100 to $150 per month - about $25 per month higher than in 1942.

Gross margins on sales ranged from 17.4 to 32.2 percent and averaged 24.3 percent. On gasoline, which had an average sales price of 16.8 cents per gallon (including tax), the margin averaged 23.4 percent or 3.9 cents per gallon. Total expenses were between 10.5 and 19.5 percent - averaging 15.7 percent of sales. Net savings averaged 10.4 percent. Selling and delivery expenses, which in audits included salaries, truck expenses and/or commissions, social security taxes, and advertising, ranged from 7.6 to 14.1 percent and averaged 11.7 percent of sales. These expenses varied because some associations handled a large volume of miscellaneous farm supplies and some operated large service stations.

PERFORMANCE RECORDS OF TRUCKS

Gallons Delivered Per Mile Driven in 1943

A common and simple measure of the efficiency with which fuel is moved by tank trucks from bulk stations to farms is "gallons delivered per mile driven." This ratio is useful in measuring improvements from year to year and in comparing trucks of similar sizes operating in comparable areas. It was the only measure generally available on the performance of tank trucks that could be used throughout this study. Further discussion of this type of ratio and suggested record forms will be found at the end of this circular.

Since December 1942, truck operators had kept daily and weekly records of gallonage delivered, mileage traveled, and fuel used in trucks so as to comply with regulations of the Office of Defense Transportation. Table 1 shows the delivery records available on 31 tank trucks of 15 associations for the first 8 months of 1943. These records covered fairly uniform operations as most of the fuel hauled was delivered to farms.

Table 1. - Average monthly volume delivered, mileage driven, and "gallons delivered per mile driven" by 31 tank trucks of 15 cooperative oil associations, January 1 - August 31, 1943[1].

Association code number	Size of truck tank	Average monthly volume delivered	Average monthly mileage driven	Gallons delivered per mile
		Gallons	Miles	Gallons
Wisconsin:				
1	500	8,629	866	10.0
	500	8,702	897	9.7
	600	5,658	956	5.9
4	500	22,808	1,448	15.8
	480	17,171	1,040	16.5
6	614	17,023	1,520	11.2
	608	15,274	1,747	8.7
	500	20,065	1,481	13.5
	500	9,437	1,485	6.4
Minnesota:				
7	550	24,398	1,215	20.1
	550	22,646	1,097	20.6
8	600	22,278	1,623	13.7
	600	25,077	1,432	17.5
South Dakota:				
9	900	13,505	983	13.8
	670	19,530	1,786	10.9
10	600	20,810	1,625	12.8
	600	17,496	1,372	12.8
North Dakota:				
11	465	19,836	1,802	11.0
	600	22,835	1,274	17.9
12	600	24,893	1,477	16.9
	500	21,503	1,447	14.9
13	580	24,412	1,558	15.7
	360			15.7
14	600	[2]23,989	1,228	19.5
17	500	20,207	1,644	12.3
	450	17,115	1,451	11.8
18	405	[2]28,289	1,811	15.6
	320	12,473	1,553	8.0
Montana:				
19	640	17,620	1,072	16.4
20	940	20,347	1,429	14.2
	640	9,540	567	16.8
Average		17,857	1,319	13.5

[1]Trucks designated by size of tanks.

[2]Includes a hired truck part of the time.

These performance records will be referred to later throughout this report. Some points of general interest, however, were as follows:

1. There was a wide variation in delivery operations of trucks. Gallons delivered per mile driven ranged from 5.9 to 20.6 during the first 8 months of 1943. One-fourth delivered more than 16.4 gallons and one-fourth less than 11 gallons per mile (see table 2). The weighted average was 13.5 and the median was 13.6 gallons per mile. Records for the entire year on 14 of these trucks showed an average of 13.1 gallons delivered per mile. The average annual volume delivered per truck was 176,139 gallons and their mileage averaged 13,442.

2. There was a marked variation in the performance of tank trucks within the same associations. Differences in trucks of associations 1, 6, and 12 were mainly due to volumes delivered, whereas mileage accounted for the variations in associations 9, 11, and 18. In association number 8, one truck delivered more fuel on less mileage than the other. In number 20, the large truck was used on longer hauls than the small one.

In only 4 associations - numbers 4, 7, 10, and 17 - were delivery efficiency results of trucks within the same association similar. Usually one truck drove more miles but delivered a correspondingly greater volume than the other.

3. Delivery efficiency of tank trucks was highest during the months of heaviest farm consumption and deliveries (see figure 2). Furthermore, the trucks comprising the upper one-fourth in "gallons delivered per mile" had a somewhat larger volume than the other groups (see table 2). The wide range in monthly annual volumes delivered per truck indicates that many trucks could improve operating efficiency after the war by increasing volume. Only about one-fourth of the trucks in 1942 and one-third of the group in 1943 exceeded an annual volume of 200,000 gallons.

4. Trucks with the highest delivery efficiency usually had the lowest monthly mileage (see table 2). Mileage increased as efficiency decreased in the second and third groups, respectively; and it was relatively high in the fourth or least efficient group considering the low volume delivered. A small change in mileage in relation to volume handled had a marked effect upon delivery efficiency (see figure 2). Truck operators, therefore, usually try to reduce unnecessary mileage in order to conserve equipment and improve efficiency because it offers immediate possibilities regardless of volume handled.

5. Little relationship existed between "selling and delivery expenses" of the associations and "gallons delivered per mile of travel" by truck operators. Since most cooperatives operated on a commission basis, such expenses were fixed for the year; however, actual expenses of truck owners would be affected by improved efficiency.

FIGURE 2

MONTHLY DELIVERY OPERATIONS OF TANK TRUCKS 1943

014321-2

Table 2. - Delivery records of 31 tank trucks grouped upon the basis of "gallons delivered per mile driven," January 1 - August 31, 1943.

Group	Number of trucks	Gallons delivered per mile driven by tank trucks		Average gallonage delivered per month per truck	Average mileage driven per month per truck
		Range in each group	Average for each group		
		Gallons	Gallons	Gallons	Miles
First	8	20.6 - 16.5	18.3	21,319	1,166
Second	8	16.4 - 13.8	15.2	18,560	1,218
Third	8	13.7 - 11.0	12.4	19,354	1,565
Fourth	7	10.9 - 5.9	8.6	11,386	1,327

Delivery Costs in 1943

The delivery cost per gallon is the most important measurement of efficiency in the delivery of motor fuels to farms. It corresponds to the records which creameries keep on procurement costs per pound of butterfat for each truck. Delivery costs should be divided into two groups: the operating cost of the truck, and the pay of the operator.

Because of variations in volume handled by trucks and in compensation of operators, the operating cost per mile is a useful measurement of truck performance. While oil firms, both private and cooperative, seldom make any difference in the price per gallon based on length of hauls or deliveries, records of total delivery costs per mile also should aid the operator in determining how far from the bulk station he can afford to make deliveries without undue expense burden. Costs per hour also might be useful should the operator question whether he can afford to make certain small deliveries. Further discussion and suggested record forms for keeping costs are to be found at the end of this report.

Detailed operating cost records on individual tank trucks had been kept in recent years in only one of the associations surveyed. While managers and truck operators owning tank trucks kept various types of records for personal income tax purposes they were not always readily available nor itemized for individual trucks. However, data were obtained from four associations on delivery costs during 1943 (see table 3). In each case the truck operators were employed on a salary basis.

Operating costs of trucks included gasoline, oil, grease, repairs, licenses, taxes, bonds, insurance, and depreciation. Such costs ranged from 0.4 to 0.5 cents per gallon of fuel delivered and slightly over 5 cents per mile traveled by most trucks. Total delivery costs averaged about 1.25 cents per gallon delivered and 15 cents per mile traveled. Such costs varied mostly with salaries paid to truck operators.

Table 3. - Delivery cost data of tank trucks of four cooperative oil associations, January 1 to December 31, 1943.

Association and item	Truck No. 1			Truck No. 2		
	Total	Per gallon	Per mile	Total	Per gallon	Per mile
	Dollars	Cents	Cents	Dollars	Cents	Cents
Association 17:						
Truck operating cost	749	0.46	5.36	687	0.40	5.19
Truck operator's salary	1,320	0.80	9.43	1,530	0.90	11.55
Total delivery cost	[1]2,069	1.26	14.79	[2]2,217	1.30	16.74
Association 9:						
Truck operating cost	662	0.42	5.49	436	0.47	5.15
Truck operator's salary	1,160	0.73	9.62	1,160	1.26	13.71
Total delivery cost	[3]1,822	1.15	15.11	[4]1,596	1.73	18.86
Association 11:						
Truck operating cost	850	0.40	3.80	725	0.70	12.21
Truck operator's salary	1,200	0.55	5.36	900	0.86	15.16
Total delivery cost	[5]2,050	0.95	9.16	[6]1,625	1.56	27.37
Association 19:						
Truck operating cost	605	0.37	-	-	-	-
Truck operator's salary	1,550	0.96	-	-	-	-
Total delivery cost	[7]2,155	1.33	-	-	-	-

[1]Gallons delivered, 163,767; miles driven, 13,986.
[2]Gallons delivered, 170,252; miles driven, 13,247.
[3]Gallons delivered, 158,955; miles driven, 12,061.
[4]Gallons delivered, 92,098; miles driven, 8,464.
[5]Gallons delivered, 214,747; miles driven, 22,376.
[6]Gallons delivered, 104,170; miles driven, 5,938.
[7]Gallons delivered, 162,148; miles driven not available.

Based upon this small sample, it appeared that delivery costs would be approximately 1.33 cents per gallon if the truck operator received an annual salary of $1,500 and delivered 180,000 gallons of fuel per year; if 240,000 gallons were delivered, the cost would be about 1.13 cents per gallon. If the truck operator received $1,800 per year and delivered 180,000 gallons, the cost would be 1.5 cents per gallon; and if 240,000 gallons were handled, the delivery costs would approximate 1.25 cents per gallon.

The foregoing indicates the importance of records on comparable trucks, volumes, and mileages in measuring truck performance or efficiency.

It is of interest that records on 31 trucks during the first 8 months of 1943 showed that one-fourth made less than 8.1 miles per gallon of gasoline and one-fourth exceeded 10.3 miles. The range was from 6.8 to 14.9 miles and the average was 9.3 miles per gallon of fuel used.

Recent Improvements in Delivery Efficiency by Three Associations

Data on three cooperative oil associations which kept delivery records in both 1942 and 1943 showed that marked improvements have been made in delivery efficiency. It appeared that most associations included in this study would have shown similar results in distributing the same or a greater volume of motor fuels on less mileage in 1943 if records for earlier years had been kept.

THE FARMERS' UNION COOPERATIVE OIL COMPANY, BLOOMER, WISCONSIN. The two tank trucks of this association operated on regular, scheduled routes in 1943. Routes were covered once a week, except during rush periods when they were made twice a week and during the winter months when they were covered every 2 weeks.

Truck No. 1 was equipped with a 500-gallon tank and a 420-gallon trailer tank was used frequently. The same operator operated the truck both years. Truck No. 2 had a 460-gallon tank but a different operator each year. The manager had kept accurate records on both gallonage and mileage the last 2 years. Both trucks handled considerably larger volume in 1943 than in 1942, but mileage was almost the same both years; hence, an increase of 25.5 percent and 28.2 percent in "gallons delivered per mile of travel" was shown by the two trucks (see table 4).

The increase in efficiency of these tank trucks was attributed to an educational program involving the following points: (1) farmers were encouraged and assisted to enlarge their storage capacity; (2) form letters and personal interviews were used in advising them to take larger fills; (3) a third truck was taken off the territory in July 1942, routes were consolidated, and thereafter a trailer tank was used part of the time with one of the trucks; and (4) early in 1943, a small card was tacked above each farmer's barrel or tank stating that gasoline and fuel oil deliveries would be made on a certain day each week; and that due to the necessity of a truck conservation program, it would not be possible to make special deliveries. The farmer's cooperation was requested and he was reminded that savings made in the cooperative belonged to the members.

While the sales of this association have increased consistently the last 5 years to the point where they were twice as large in 1943 as in 1939, total expenses per dollar of sales have consistently declined each year. In 1939, expenses were 15.3 cents per dollar of sales; in 1940, 14.3 cents; in 1941, 13.9 cents; in 1942, 12.9 cents; and in 1943 they were only 11.8 cents per dollar of sales.

Table 4. - Petroleum delivery records of two tank trucks of the Farmers' Union Cooperative Oil Company, Bloomer, Wisconsin, during the years January 1 to December 31, 1942 and 1943.

Item	January 1 - December 31 1942	January 1 - December 31 1943	1943 as a percentage of 1942
Truck No. 1:			
Gallons delivered	210,399	287,608	+36.7
Miles traveled	15,375	16,711	+8.7
Gallons delivered per mile	13.7	17.2	+25.5
Truck No. 2:			
Gallons delivered	173,883	222,987	+28.2
Miles traveled	13,310	13,273	-0.3
Gallons delivered per mile	13.1	16.8	+28.2

THE ELLSWORTH COUNTY FARMERS UNION COOPERATIVE OIL COMPANY, ELLSWORTH, WISCONSIN. This association's trucks made deliveries on the basis of "orders." All trucks were equipped with either 500- or 600-gallon tanks and hand-pumps. One trucker delivered 136,289 gallons of liquid fuels and drove 10,949 miles from December 1, 1940, to June 30, 1941. This was an average of 12.4 "gallons delivered per mile." From December 1, 1942, to June 30, 1943, this same truck delivered 140,548 gallons and drove 9,011 miles, an average of 15.6 gallons per mile. This was an increase of 3.2 gallons per mile or a 26 percent improvement in efficiency. Gallonage delivered was about the same during the two periods (up 2.3 percent in 1942-43), but the 1942-43 volume was delivered with a 21.5 percent reduction in mileage traveled.

The general manager attributed this improvement to better grouping of orders; filling in of customers in certain sections of the truck operator's territory during the last 2 years; and to the fact that he handled an estimated 60 percent of the farm business in his territory in 1943. No change in the size of his truck tank nor any appreciable increase in the amount of storage facilities on farms had been made during the period. The "gallons delivered per mile" of travel by this operator averaged considerably higher than for the other truck operators in the company - partly because he operated in more level prairie country having more tractor farming, delivered a larger proportion of burner or fuel oil, and handled 15 to 20 percent more volume of all products.

THE FARMERS UNION OIL COMPANY, REGENT, NORTH DAKOTA. This cooperative had two tank trucks which made deliveries on an order basis. One was equipped with a 450-gallon tank and a hand-pump. The first 8 months of 1943 it delivered 119,803 gallons of light fuels and

oil and was driven 10,155 miles - an average of 11.8 "gallons delivered per mile of travel." The other truck had a 500-gallon tank and a hand-pump. It delivered 121,201 gallons and traveled 9,865 miles, or an average of 12.3 gallons per mile. During the fiscal year ending June 30, 1942, the two trucks together delivered approximately 320,000 gallons of fuels and were driven about 40,000 miles - an average of 8 "gallons delivered per mile." The average of the two trucks from January 1 to August 31, 1943 was 12 "gallons delivered per mile," which was an increase of 50 percent in efficiency over the same period in 1942. The first truck had the same operator both years, but the second had experienced two changes in operators since June 1942.

This improvement in delivery efficiency was attributed to the following: (1) During the last 3 to 4 years, farmers had been getting 250- to 300-gallon storage tanks as a result of a pre-war effort by the cooperative to get more of them out on farms. It was estimated that 60 percent now have such tanks. (2) The manager says that since the war farmers have been 100 percent more prompt in giving adequate notice for fuel needs. (3) Special calls were made only for orders of 300 gallons or more of fuel, whereas they were made on a 50- or 100-gallon order before the war. (4) In the spring of 1942, the number of trucks operated was reduced from three to two. The two left in operation have no definite territories but get together each morning and work out routes on the basis of the orders on hand. It remains to be seen whether they will deliver as large a volume as the three trucks did the previous year. In serving the same membership, no doubt it has been necessary for them to have more advance notice for fuel and better grouping of orders, which should result in improved efficiency.

FACTORS AFFECTING DELIVERY CONSERVATION AND EFFICIENCY

Care of Tank Trucks

The 21 cooperatives included in the study had 52 regular tank trucks in operation during the spring of 1943. Each of 3 associations operated 1 truck; 13 each operated 2 trucks; 2 operated 3 apiece; 1 had 5; and 3 associations each operated 6 trucks. In addition, each of 4 associations had a pick-up truck equipped with a small tank for relief and miscellaneous work. A few hired an extra truck during seasons of heavy fuel consumption.

Three associations were conserving equipment, fuel, and manpower by delivering the same or more volume in 1943 with one less truck than in 1942. Another was using its fifth truck only part of the time in 1943. One was delivering more fuel with 2 trucks in 1943 than with 5 in 1940 when it was attempting to develop business over a large territory. Still another was handling more volume in 1943 on a "come and get it" basis with 2 trucks than with 5 trucks delivering most of the fuel in 1939.

Tank trucks were owned entirely by associations in 2 cases, by managers in 12 associations, by truck operators in 5, and by both managers and truck operators in 2 organizations. Thirty-seven had a rated capacity of 1½ tons; 9 were 1-ton trucks; 1 was 1¼ tons; 2 were ¾ tons; and 1 was a 2-ton truck.

Practically all were between 2 and 5 years old, and the majority had from 35,000 to 85,000 miles on them. Managers were of the opinion that most of their trucks could be used 2 years more if given good care, as approximately two-thirds were considered to be in fair to good condition.

Managers reported that operators of the trucks had taken much better care of them since the beginning of the war. They were driving more slowly and carefully, checking tires and mechanical parts more frequently, and making repairs earlier than usual to avoid serious trouble or breakdowns. They were especially careful in avoiding deliveries over bad roads which might tear up their trucks.

Two cooperatives with several trucks maintained their own repair shops. One had two extra motors reconditioned and ready for emergency use. Reports from managers indicated that it was desirable for an association to have trucks of the same make. This enabled them to keep a more complete stock of repair parts and to obtain a mechanic well-trained on that particular make of truck.

Size of Truck Tanks

Capacity of the truck tanks ranged from 350 to 990 gallons and averaged around 550 gallons:

Capacity of tanks	Number of tanks
350-450 gallons	11
451-550 gallons	18
551-650 gallons	13
651-850 gallons	6
851-990 gallons	4

Tanks on all delivery trucks were owned by the associations. Most of these tanks had three or four compartments and a few had five. Several managers expressed a desire for larger tanks so that more compartments would be available for different fuels. Frequently the orders on hand are for more grades of fuel to be delivered to a community than the number of compartments in a truck tank.

Delivery records on 31 tank trucks in 1943 showed that trucks equipped with tanks having capacities of 600 gallons or more delivered about 12½ percent more fuel per mile of travel than those with capacities of less than 600 gallons (see table 5). It was unfortunate, however, that more records were not available on trucks equipped with tanks having capacities of 800 gallons or more.

Table 5. - Average "gallonage delivered per mile driven" by 31 tank trucks classified accordingly to capacity of tanks, January 1 - August 31, 1943.

Size of truck tank	Trucks operated	Average gallons delivered per mile driven
	Number	Gallons
Less than 400 gallons	2	10.6
400-499 gallons	4	13.5
500-599 gallons	11	13.4
600-699 gallons	12	14.2
700 gallons and over	2	14.0

There has been a trend toward the purchase of larger tanks for replacements or for new trucks. The last 5 years, about one-third of the trucks have been equipped with tanks having 100-150 gallons greater capacity; however, most managers stated that they would obtain even larger tanks now if possible as one means of improving efficiency. A few cooperatives enlarged their tanks by lengthening them; that is, another compartment was welded onto the end of the tank if the wheel base of the truck was long enough to accomodate it. Only one company used a trailer tank (420-gallon capacity) and this as a result of operating only two trucks in 1943 instead of three as in former years. All trucks carried one or more side barrels most of which were used for oil.

Mechanical Unloading Equipment and Meters

Thirty-seven, or 71 percent, of the 52 regular tank trucks were equipped with the following types of mechanical unloading equipment:

Hand pump	20 trucks
Power take-off pump	9 trucks
Gasoline pump	7 trucks
Magneto rotary pump	1 truck

Power take-off pumps, however, had been ordered for 4 of the trucks now equipped with hand pumps and for the 1 truck with a magneto rotary pump. Unloading pumps had been ordered for 3 of the trucks without such equipment.

With more farmers acquiring overhead tanks, it is necessary for delivery trucks to be equipped with some type of mechanical unloading equipment. Another advantage of such equipment, particularly during war time, is that older men can be used in delivering fuels than when the unloading is performed by hand.

It is difficult to measure the improvement in efficiency from mechanical unloading equipment as compared with unloading by hand with cans or buckets. One truck operator believed that an unloading pump saved him 2 hours per day during busy seasons. Another said that one man could unload a tank of fuel with a power-driven pump as fast as two men could unload it by hand. Still another said it cut the unloading time in half. Furthermore, the use of such equipment gives the truck operator time to arrange barrels, make out tickets, and take care of other details while the fuel is being unloaded. Most truck operators believed that the power take-off pump was the most satisfactory.

Only nine tank trucks were equipped with meters, but such equipment had been ordered for six additional trucks. Meters are considered desirable as they make possible more accurate measurements and thus reduce shrinkage. They are also helpful when several small deliveries are to be made with trucks equipped with unloading pumps. Unless there is a meter, the unloading pump can be used only when orders involve full compartments of fuel.

While most of the tank enlargement programs will have to wait until after the war, priorities for several pumps and meters had been obtained and the purchase of such equipment might well be considered by associations to speed up deliveries and thus make more efficient use of trucks and manpower.

Petroleum Storage Facilities on Farms

Delivery trips to a farm can be kept to a minimum only if it has adequate storage capacity in relation to its seasonal fuel needs. In 1944, managers of the Wisconsin and Minnesota cooperatives reported most farmers had from one to three 55-gallon drums for each main type of fuel. Progressing westward into wheat farming areas with larger farms, farmers had four to six barrels and many had large storage tanks (from 200 to 600 gallons in capacity) for their principal fuels.

An analysis of farm storage in relation to fuel consumption had been made by only one association, but older truck operators usually knew the farms most in need of additional capacity. Storage equipment for motor fuels was generally owned by the farmers, but some associations loaned them oil drums.

All associations in recent years have conducted educational work on the advantages of adequate farm storage, mostly on a personal basis by managers and truck operators. As a result, several western associations reported that from 25 to 120 large tanks had been purchased by their patrons the last 3 to 5 years. Several reported that one-half to two-thirds of their farmer-patrons now had such equipment. Additional 55-gallon drums had been obtained by many farmers in Wisconsin and Minnesota - one cooperative reported selling 400 drums the last 5 years. However, the Government's limitation order, which in 1942 restricted the sale of farm storage equipment, halted the enlargement of fuel

storage on farms. As a result, extra delivery trips and increased mileage have been necessary to keep farmers supplied with motor fuel.

Demand from farmers for storage tanks and drums has naturally increased since the war by reason of the following factors: (1) encouragement from oil associations to take larger fills so as to reduce frequency of calls and hence truck mileage; (2) favorable crop and economic conditions that encouraged farmers to purchase equipment and to take larger orders; (3) the desire to keep a supply of fuel on hand as a safeguard against possible shortage; (4) the convenience of larger equipment; and (5) reduction in shrinkage as compared with the use of barrels.

The large tanks acquired by farmers in the western cooperatives have generally been of two sizes - the more common held 250 to 300 gallons for 1-tractor farms, and the others 500 to 550 gallons for 2-tractor farms. In the wheat farming area, most tanks have been installed above ground either on low stands, overhead platforms, or on sleds. A few have been mounted on trailers. Most of those in Wisconsin were installed underground.

Most cooperatives sold storage tanks to farmers at cost. One reported that one cent per gallon was added to the buyer's cost of each fuel purchase until the tank was paid for. Another cooperative sold at cost 40 underground tanks just before the United States entered the war, and loaned a farm service (dispensing) pump with each.

A demonstration or exhibit of storage tanks mounted on overhead stands proved to be a good educational device to promote increased storage in the association at Rugby, North Dakota. One tank was mounted on an open rack near the general office of the cooperative. Another was conveniently located on the graveled driveway of a farmstead near town. It was enclosed in a small building that just fit the tank. The lower part of the building was used for oil and grease drums, cans, funnels, and greasing equipment.

The manager of the above association suggested that the Farmers Union Central Exchange investigate the post-war possibilities of having manufactured a storage tank and a steel platform which could be sold as a combination unit or as separate units. His description of the suggested unit follows:

> Two sizes of tanks should be provided - a 300- or 350-gallon tank for a 1-tractor farm and a 450- or 500-gallon one for a 2-tractor farm. The tank platform and tanks should be constructed so that these tanks would be interchangeable. They might be mounted vertically to give more pressure, in which case they would have to be the same in diameter to fit the platform. The platform under the tank could be enclosed with doors on two or more sides to give access to oil and grease drums. The floor should be some distance above the ground to permit easy handling of drums. The tank need not be covered. It could be equipped with a hose and faucet, a guage, and possibly a lock, in which case one set of keys might be turned over to the cooperative truck operator.

Farmers could purchase such equipment outright, or the cooperative might let them pay for it with their patronage refunds. In the latter case, they might be given capital stock in the cooperative rather than title to the equipment. Such a plan would involve some initial outlay of funds by the association but would enable it to place more of these tanks where they were needed. Where the cooperative owned the equipment, it might wish to paint the name, sign, and phone number of the association on the tank or on the building housing it. The convenience and serviceability of such equipment should appeal to many farmers.

Cooperatives also have helped the farm storage situation during the war by redistribution of drums where most needed. When a farmer acquired a large storage tank, they tried to place his extra barrels, if any, in the hands of those farms short of storage. Also, some of the cooperatives have arranged for the temporary exchange of barrels by winter fuel oil users and summer motor fuel users. The truck operators were in a good position to make these transfers where they would be of most benefit during the war period.

Unfortunately, the effect on delivery efficiency of increased farm storage equipment and larger fills could not be measured as delivery records on individual trucks had not been kept prior to the increase of storage capacity. Truck operators stated, however, that both were of great help in reducing the number of required trips per farm. Some doubted that they could have kept farmers supplied with fuel under war-time transportation regulations if farmers had not had these tanks.

The importance of analyzing patrons' daily purchase records and performance as a basis for adjusting farm storage capacity is discussed in a later section of this report.

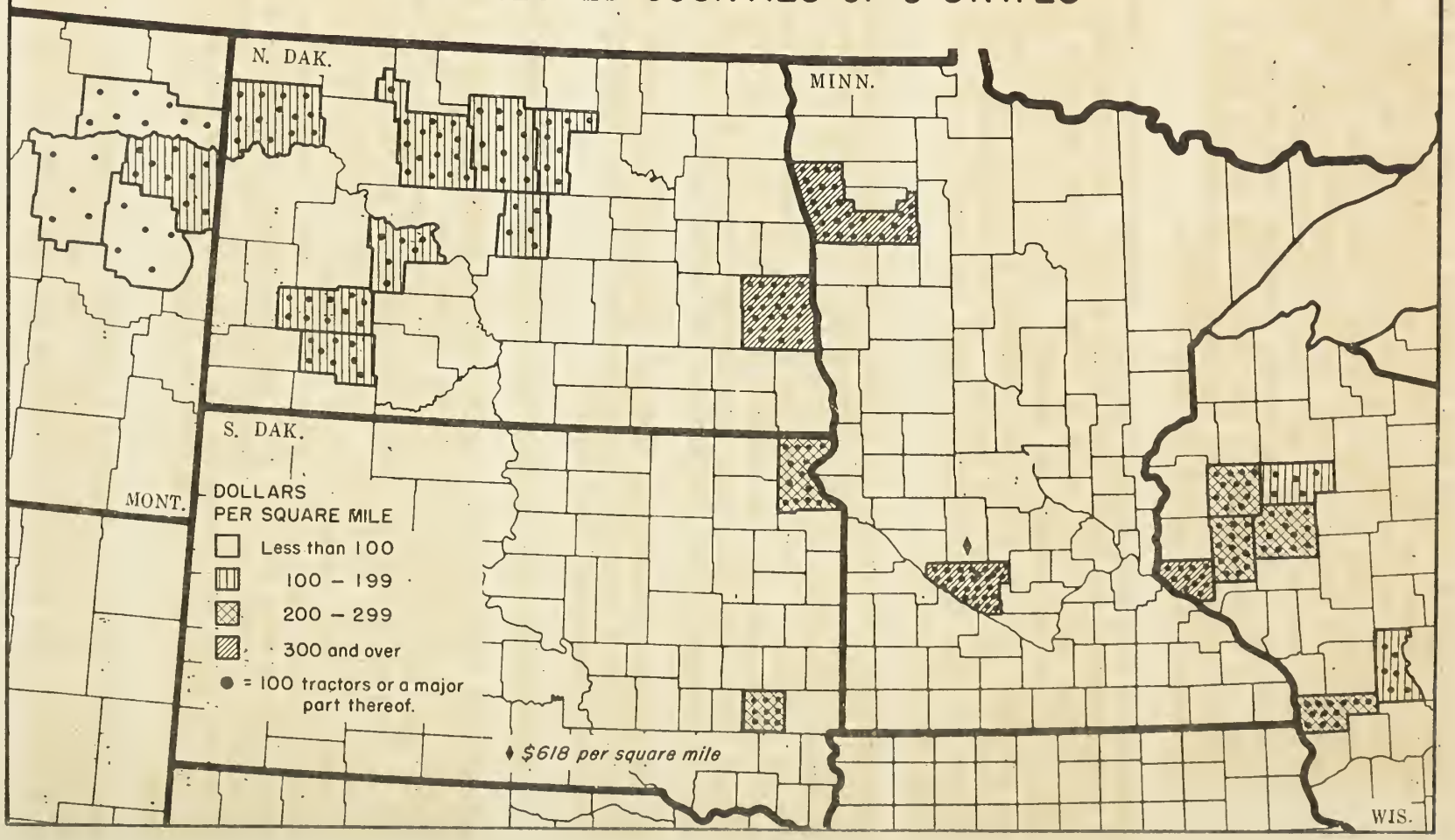
Agricultural and Topographical Features of the Area Served

Agricultural features that usually affect rural delivery of motor fuels include size and density of farms, proportion of land in farms and in crops, type of farming, and extent of power farming in the area. These affect both total and seasonal consumption of petroleum fuels, number of stops, and size of fills. These factors together with topographical features and road systems affect the amount of travel required in delivering fuel for a given area. Since the 21 cooperative oil associations studied were located in 5 States ranging from highly extensified agriculture in Montana to intensified dairy sections in Wisconsin and Minnesota, data pertaining to the above factors for the counties served by the cooperatives are included in tables 6 and 7 at the end of this report.

Considerable variation existed in number of tractors and in farm expenditures for petroleum products (see table 7 and figure 3). While in Wisconsin the numbers of tractors per 100 farms and per square mile

FIGURE 3

NUMBER OF TRACTORS IN 1940 AND FARM EXPENDITURES FOR PETROLEUM PRODUCTS PER SQUARE MILE IN 1939 IN SELECTED COUNTIES OF 5 STATES



014321-3

were relatively low, there were from 5 to 7 tractors per 1,000 acres of cropland - more than in any other area studied. Likewise, petroleum expenditures were comparatively high even though only 12 to 48 percent of all land was classified as cropland. This high consumption was apparently the result of more continuous year-round use of tractors in diversified farming.

Trucks operating in level areas with a relatively high proportion of cropland usually delivered a higher gallonage per mile than those operating in the rougher territories (table 1). This was an important cause of variation in the records of associations 1, 4, and 6 in Wisconsin.

The trucks with the most efficient deliveries generally operated in areas with favorable conditions of petroleum consumption and distribution. For instance, the trucks of association 7, which had the highest gallonage delivered per mile, operated in a county having 88 tractors per 100 farms, and in the county with the highest farm petroleum expenditures per square mile. Furthermore, the association operated in a relatively small or concentrated territory, and handled about 90 percent of the farm petroleum business in its trade area. Associations 8, 11, 12, and 14, all high in gallons delivered per mile, ranked rather high with respect to these same factors.

Delivery Systems

Nineteen associations delivered most of the motor fuels which they supplied to farmers. Sixteen of these, largely in Minnesota and the Dakotas, made daily deliveries on the basis of "orders" or "calls." Two cooperatives in Wisconsin made deliveries on regular, scheduled routes, and another reported about 50 percent on each basis. A majority of the farmers in the other two organizations (in Montana and in western North Dakota) hauled their own fuel from bulk plants to farms.

The systems used by cooperatives were those customarily followed by other oil companies in their communities. Under each, an association's truck operators usually served definite territories - each having about the same area and fuel volume or potential volume. Railroads and main highways were the principal boundaries. Length of service and acquaintanceship were factors determining assignment of truck operators to territories.

REGULAR ROUTES. Discussions of advance notices or orders for fuel and minimum size of deliveries are included in later sections of this report. Only a few trucks were following regular routes in 1943. Routes generally covered once a week except during rush seasons are now covered every 2 weeks as a rule. Some managers thought monthly coverage of routes during slack seasons might be considered when storage on farms could be adjusted to hold 4-weeks' supply of fuel. One Wisconsin association changed to an "order" basis in rush seasons. Truck operators on regualr, scheduled routes contacted from 15 to 20 farmers per day, but the number of sales or deliveries averaged somewhat less.

A truck operator in North Dakota and one in South Dakota were operating regular routes during slack seasons in 1943. One had four routes that were covered weekly. The other had one route 30 miles in length (one way) which it took 3 days to cover. He worked it on each Monday, Wednesday, and Friday. Thus some patrons were serviced two or three times per week - others once a week. All patrons were requested to place orders by postcard.

Because of the limited number of trucks operating on "regular routes," it was not possible to draw conclusions as to the merits of this system compared with the "order" system. About the same degree of variation existed in "gallons delivered per mile driven" in 1943 by trucks operating on each basis. It appeared that other factors were more important than the type of delivery system used. Managers thought that regular routes were better adapted to areas of dense farms, diversified farming, relatively steady or consistent petroleum consumption throughout the year, and sections where the land was rough and the roads generally followed ridges and valleys.

DELIVERIES "ON ORDER." It was pointed out that regular routes were preferable in build-up sales of miscellaneous farm supplies. On the other hand, one manager questioned the effect of competition when routes were covered every 2 to 4 weeks rather than once a week or on "call." The same problem might be encountered, however, if "call" deliveries were delayed too long, or if exceptionally large deliveries were made to a farm only a few times per year.

It was the opinion of managers that deliveries should be made "on order" in areas having large farms with heavy petroleum consumption, as in heavy wheat producing areas where tractors are used primarily on a seasonal basis.

Where either system might be used, they believed that usually a higher gallonage could be delivered per mile of travel when deliveries were made on orders with advance notice.

It was apparent that further study of the use of regular routes should be made, especially in Wisconsin and other areas where both route and order systems are in use.

"COME AND GET IT" OPERATIONS. Although this study deals primarily with fuel delivery operations of farmers' oil associations, a brief discussion is included of two organizations from whose bulk stations farmers hauled their own fuel, thus eliminating the use of cooperative delivery equipment. This system, called the "come and get it" or dock station system (self-service, cash-and-carry, or track-side operations in other areas) was used by most oil cooperatives in Montana.[1]

[1] It was also reported that this system was used by a few associations in eastern Wisconsin where members were concentrated in valleys and their fuel consumption was steady throughout the year.

In that area, farms were large and scattered and distances comparatively great; hence the cost of maintaining delivery service would be high.

A Montana cooperative had its dock station built into one side of the service station building, and two large pumps and meters on 2-inch lines were installed at the height of a truck bed for convenience in filling barrels on trucks. Automobiles were serviced from two meter pumps at the service station. Many farmers had trucks in which from 1 to 6 barrels were hauled. Others used cars and trailers for hauling fuel. Most farmers had 5 or 6 barrels for farm storage and some as many as 10 or 15.

Since the beginning of the war farmers had cooperated in obtaining their fuels and other supplies by picking up empty barrels from neighbors along the way and bringing back supplies for them.

The cooperative had one ordinary truck in which two 300-gallon tanks were used for making special deliveries; these represented not more than 10 percent of the total volume. When fuel was delivered, a charge was made at the rate of $\frac{1}{2}$ cent per gallon for each 10 miles from the plant. No charge was made for delivering grease and supplies when in connection with fuel orders. Farmers ordering fuel to be delivered had to wait until enough orders were received to make up a full load; therefore, some farmers endeavored to line up other orders among their neighbors.

In 1942 this association handled 428,653 gallons of refined fuels. The capacity of its bulk station tanks totaled 40,500 gallons. Sales totaled $116,063, of which petroleum products constituted $83,789. Gross margins averaged 24.3 percent and other income 2.6 percent on sales. Gasoline margins averaged 20.5 percent, or 4 cents per gallon. Total expenses were 12.5 percent on sales, which was 3.2 percent per dollar of sales below the average of other associations in the study. Total net savings were 14.5 percent, or 4 percent per dollar above average. The association served 600 patrons in a territory about 15 miles both east and west and 35 miles both north and south. It handled about one-third of the available volume among seven competitors, some of which operated tank trucks.

A director of this cooperative believed that the "come and get it" basis was the most economical way for farmers to obtain their motor fuels, because they came to the town once a week anyway. He thought most farmers tried to conserve their trucks by tending to other business on the same trip, and avoided special trips for fuel only. He thought such a system was less wasteful than deliveries "on call," with excessive duplication of travel by trucks, peddling of fuel, small fills, and partial loads returned to stations.

An association in western North Dakota was handling about 60 percent of its volume on a "come and get it" basis in 1943. It operated only two trucks compared with five in 1939 when most of the volume was delivered. Volume of light fuels had increased from 611,746 gallons in 1939 to 853,134 in 1942. This association gives 1 cent per gallon discount to farmers who come for their fuel[2]. If a farmer comes to the office and orders fuel to be delivered on short notice, the cooperative often loans him a barrel in which to take some home. This has helped to reduce extra trips by either the farmer's or the cooperative's truck. Most farmers obtained their fuel from the service station where 9 pumps were in operation.

The manager of this association stated that if the truck situation became too critical, sales might be made solely on a "come and get it" basis. In fact, he would prefer such a basis but as some farmers had 300- to 500-gallon storage tanks, many of which were mounted on overhead racks or stands, one or two trucks will always be needed.

The manager of another Montana cooperative believed the "come and get it" basis the most economical long-time system for farmers, but lack of drums and of farm trucks for hauling them prevented adoption of this program during the war.

Advance Notice on Orders for Fuel

Since the war began, cooperative oil associations delivering "on call" have made a strenuous effort to get farmers to give more advance notice of their fuel needs. It was pointed out that ample notice enables the truck operator to group orders and plan daily routes in one neighborhood, and thus dispose of a load of fuel on a minimum mileage. As a result, many farmers are giving 24 to 48 hours notice instead of 12 hours or less as before the war. Since June 1, 1943, Office of Defense Transportation regulations have required 48 hours notice on orders for petroleum products[3].

Urging farmers to wait for delivery until sufficient orders had accumulated from their community to make up a full truck load of fuel has been a helpful practice. In fact, several truck operators would not leave the bulk station until they had enough orders for a full load. Others required orders for 75 percent of a load and wanted to be reasonably certain that the remainder could be disposed of nearby. As stated, associations reported that some farmers were lining up orders among their neighbors before notifying the cooperative of their own needs. These

[2]The previous association which has always handled most of its volume on a "come and get it" basis expressed its policy in terms of "charges per gallon for delivery service."

[3]The O.D.T. General Order No. 37, Part 501 - Conservation of Motor Equipment, Subpart Z - "Less-than-truckload deliveries by petroleum tank trucks," Section 501.342 - "Operating requirements" (effective June 1, 1943) provided: (a) Every tank truck operated for the purpose of making less-than-truckload deliveries of motor fuel or fuel oil shall be dispatched with a full load and routed in a manner that will best conserve mileage and time; and (b) In order to facilitate operation in accordance with the above requirement, no person, notwithstanding any provision of contract or agreement to the contrary, shall be required to make any less-than-truckload delivery of motor fuel or fuel oil by tank truck within less than 48 hours of receipt of the order therefor.

practices helped truck operators to group orders in one direction from the bulk station, to comply with Office of Defense Transportation regulations regarding full load dispatching (see footnote 3), and to arrange fuels by compartments so that back-tracking could be kept at a minimum. Only one cooperative, however, was keeping a daily record of both gallons of fuel hauled and gallons delivered by each truck. During the first 6 months of 1943, the 4 trucks delivered 56, 58, 76, and 89 percent, respectively, of the volume hauled.

Other associations reported that farmers with 2 or 3 barrels for one type of fuel were encouraged to notify the cooperative as soon as one became empty. Another cooperative paid the telephone toll calls of any patrons who ordered fuel in this manner.

While farmers recently have been much more prompt in giving advance notice of their petroleum needs, all associations reported that there was still room for improvement. Several managers believed it was up to the employees to continue urging farmers to change their habits and give more notice; and that information, encouragement, and patience should predominate rather than criticism. A bookkeeper in one of the cooperatives emphasized the value of thanking patrons when they gave notices for fuel well in advance of the time it was needed. He also believed that if they understood how this helped the cooperative to meet transportation regulations and to operate more efficiently, they were more likely to cooperate.

"Standing Orders" Among Farmers

Among the members of each cooperative were some farmers who had "standing orders" for fuel. That is, the truck operator had an understanding with the farmer to "keep his barrels full," or that he could use the farmer's storage facilities for disposing of extra fuel remaining in his tank truck. Of 18 cooperatives reporting, 8 estimated that 25 to 50 percent of their farmers had "standing orders"; 3 reported from 10 to 24 percent; and 7 stated that less than 10 percent of their patrons had such an understanding with their truck servicemen.

Several cooperatives with a small percentage of patrons having "standing orders" reported that each truck operator had three or four farms which could be used somewhat as "dumping stations." This aided trucks in returning empty to the bulk station. Managers mentioned that the credit rating of patrons and the necessity of obtaining war-time ration coupons were factors affecting the extent to which "standing orders" could be used at present. Outlying service stations and dealers with curb pumps supplied by the cooperatives also served as convenient "dumping stations" for truck operators. Furthermore, the truck operators frequently obtained from the stations some additional fuel to complete orders in their communities and thus avoided extra trips.

Occasional or chance fills for which no previous orders had been given helped truck operators to return to bulk plants with empty truck tanks.

Minimum Drops or Fills

An analysis was not made of the sizes of deliveries or fills by truck operators during 1943 compared with pre-war operations.[4] While they varied greatly among farms and seasons, truck operators stated that this helped in making better use of trucks. They believed, however, that fills or dumps would have averaged much larger in 1943 if additional storage equipment could have been obtained.

All associations had encouraged farmers to take larger quantities of fuel at one time. Some have held up small deliveries if they involved extra mileage or time. Some cooperatives with a policy of a minimum drop or delivery of 25 gallons before the war have raised this to 50 gallons; two increased their minimum from 50 to 100 gallons; and a Montana association was requiring a 400-gallon minimum on deliveries beyond 10 miles of its bulk plant. Thus many were already in line with Office of Defense Transportation regulations on minimum drops which became effective June 1, 1943.[5]

One association charged service station prices on orders of less than 25 gallons; also a discount of $1\frac{1}{2}$ cents per gallon was given to any farmer purchasing 1,000 gallons or more of fuel during a calendar year. Another cooperative gave a discount of $1\frac{1}{2}$ cents per gallon to farmers who purchased 200 gallons or more at one time, with the petroleum salesmen absorbing $\frac{1}{2}$ cent per gallon of it.

Most managers believed that a minimum dump policy was desirable and that by some educational work most farmers would cooperate with it. While it might cost as much or more to make a small delivery as a large one, and therefore an extra delivery charge in terms of an added price per gallon would be justified, this was not considered practicable from a competitive standpoint. Most managers believed that volume discounts would encourage certain farmers to purchase a greater percentage of their fuel requirements from the cooperative, but they did not consider it necessary or altogether cooperative in principle as small users were just as loyal as large ones.

[4] For detailed information on the efficiency of petroleum deliveries to farms in Iowa, refer to "Farm Petroleum Delivery," by W. T. Maakestad and Frank Robotka. Iowa Bul. P52, 1943.

[5] Provisions in O.D.T. General Order No. 37, Part 501 - Conservation of Motor Equipment, Subpart Z - "Less-than-truckload deliveries by petroleum tank trucks," Section 501.343 - "Minimum drop provisions for motor fuel deliveries" stated: (a) When deliveries are made other than by compartment lots, the minimum drop shall be: (3) To a farm, either the amount necessary to fill the storage tanks or tanks for a particular grade or brand of fuel to their proper full level, or a quantity not less than 60 percent of the total storage capacity of said tank or tanks, but in no case less than 25 gallons; provided that when delivery is accepted of a total amount aggregating at least 50 gallons made up of various kinds of liquid petroleum products, there is no minimum requirement on the amount of any one particular product that must be delivered. In no case is a single delivery of more than 150 gallons required. (b) When delivery is made by compartment lots, the minimum drops shall be the lesser quantity stipulated above but that nearest to it that can be attained by completely emptying one or more compartments. (c) There is no minimum drop requirement when: (1) The delivery completes the emptying of the tank truck; or (2) At the same time and place of delivery some other type or brand of motor fuel is delivered by the same tank truck in a quantity complying with the minimum drop provisions set forth in paragraphs (a) or (b) above.

Elimination of Unnecessary Calls and Call-Backs

The cooperative oil associations included in this study have discontinued solicitation of business with tank trucks. Among the reasons were the need for reducing mileage to conserve trucks and tires, more advance ordering from one neighborhood, and the fact that many had all the business they could handle. Since June 1, 1943, regulations of the Office of Defense Transportation have prohibited most practices involving calls or call-backs by tank trucks other than for loading or delivery of petroleum products.[6]

Several truck operators reported that before the war they had solicited business when they had insufficient orders for a full load of fuel, when they went into a new territory, or when new farmers moved into their territory. While this involved "peddling" of gasoline, managers also considered it solicitation of new members for the cooperative. In the case of regular routes, prospective or irregular patrons often could be contacted without incurring any extra mileage.

In developing an efficient delivery system after the war, cooperative truck operators probably will find it necessary to solicit some new members and patrons. If they are successful in getting all the farmers on a regular route as patrons, or in getting all in a certain neighborhood to order fuel well in advance, it will contribute much toward delivery of a maximum volume of fuel on a minimum mileage.

Few cooperatives have ever used their tank trucks in collecting outstanding accounts receivable, but since the war this practice has been discontinued completely. Increased income of farmers in recent years and restriction or elimination of credit by cooperatives has reduced the problem of collection. Furthermore, farmers have cooperated in making ration coupons available so that few extra calls were required to collect them.

[6] In O.D.T. General Order No. 37, Subpart Z, Section 501.344 - "Certain practices prohibited" provided that: "No person shall make or cause to be made any call by a petroleum tank truck for a purpose other than the loading or delivery of liquid petroleum products in bulk except: (a) Calls for the purpose of servicing, maintaining, or repairing a tank truck; (b) Calls for the purpose of pumping out storage tanks; (c) Calls for the purpose of delivering any type of petroleum product or any service station supplies, when such deliveries are made from a tank truck dispatched with a full load of liquid petroleum products and routed in a manner that will best conserve mileage and time; and (d) Calls for the purpose of picking up materials if the pick-ups are made by a tank truck while operated for any of the foregoing purposes and without adding to the mileage of such truck. (Paragraph (d) was added by amendment 1 to the order on September 10, 1943.)

Section 501.345 - "No call-backs to be made" stated that: Whenever a call is made by tank truck for the purpose of making a less-than-truckload delivery of motor fuel or fuel oil, and the operator for any reason fails to make or complete the intended delivery, no subsequent call shall be made on the same calendar day for the purpose of making or completing that intended delivery, unless the subsequent call: (a) completes the emptying of the cargo tank or tanks of any tank truck; or (b) is made by a tank truck that is making any other delivery of motor fuel or fuel oil at the same premises.

Miscellaneous Delivery Practices and Operating Policies

ADVANCE PURCHASE OF REQUIREMENTS BY FARMERS. Rationing of fuel and threats of general shortages have encouraged farmers to fill their petroleum storage facilities well ahead of the heavy seasons of field work, and to keep them filled, insofar as possible, during these seasons. Although lack of storage equipment was a retarding factor, this fuel build-up program aided truck operators in spreading their heavy spring, harvest, and fall deliveries over a longer period, thus enabling them to give better service to members. Future oil and grease sales each fall or winter also helped to level out peak loads of the servicemen.

NUMBER OF FUELS HANDLED. Most cooperatives delivered regular and third grade gasoline, distillate, tractor fuel, kerosene, motor oil, and grease. Some also handled stove and light gasoline, diesel fuel, and fuel oil or burner fuel. One association had discontinued handling distillate and three others stated they would like to eliminate at least one type of light fuel. It was believed that a reduction in the number of fuels would simplify the routing of orders and the servicing of farmers located on regular routes, especially where truck tanks were short on compartments. As mentioned, truck operators frequently would have orders for five different fuels to be delivered with only a 4-compartment truck tank.

THE COUPON RATIONING SYSTEM. All managers reported that collecting coupons under the rationing system had slowed down deliveries, and lack of coupons frequently prevented truck operators from filling some tanks while in a locality.

The associations were cooperating with both rationing and transportation conservation programs, but at the same time they were endeavoring to work out the most practical way of handling the details of the coupon system. Otherwise call-backs for deliveries or for collecting coupons would have incurred extra mileage and time, and thus defeated transportation and fuel conservation objectives. Farmers were encouraged to leave their coupons at home instead of carrying them. One association reported that some farmers kept their coupons in special boxes in various farm buildings to which truck operators had access. A few associations favored developing a system wherein farmers' coupons for bulk deliveries would be kept in the office of the cooperative. Employees said this would insure getting all the coupons and reduce extra mileage by truck operators in hunting farmers and collecting coupons. Several managers, however, did not favor this because of the extra work and misunderstandings which might result.

Two managers thought there should have been some 50- and 25-gallon coupons, as they would have encouraged deliveries of 150 gallons instead of 100 gallons. Another took opposite views stating that 100-gallon coupons encouraged larger fills than would have 50-gallon ones.

DISCONTINUANCE OF DELIVERY SERVICE. Only one cooperative reported discontinuing delivery service to scattered customers in isolated or distant corners of its territory. Another association which delivered most of its volume a few years ago had gradually increased the proportion of dock station business until it represented 60 percent and deliveries only 40 percent in 1942.

Various types of farm supplies were delivered to farmers by truck operators, but only in conjunction with fuel deliveries, or where such farms were located on roads or routes which involved no extra mileage. None of the associations reported any exchange of patrons with adjoining cooperatives or other oil companies where territories over-lapped.

INCREASED USE OF WOMEN. Cooperative oil associations have relied more on women for bookkeepers since the war, and some have found it necessary to add another girl to handle work pertaining to wartime regulations. Only one association reported employing a woman to operate its tank truck; however, plans were being made to have her keep books and wait on customers at the office in the near future.

AIDS IN DEVELOPING DELIVERY EFFICIENCY

A Definite Program

Adoption of a definite program to improve delivery efficiency should be the first step toward that goal. The close correlation between volume delivered and efficiency and the variations in performance of trucks within the same association and in adjacent associations indicated that all cooperatives have within their control means of improvement.

Records of truck operators recently increasing efficiency 25 to 50 percent showed that improvements were accomplished through a program involving adjustment and coordination of several factors. The more common included size and type of delivery equipment, capacity of farm storage, size of orders, grouping of orders, advance notice for fuel, special deliveries, frequency of covering regular routes, and addition of new patrons and volume.

While wartime conditions prompted cooperation from farmers on improved practices, much credit was due managers and truck operators for their efforts in adopting certain policies and then conducting the educational work needed to get cooperation from patrons. It is evident that a program geared to conservation of delivery equipment and efficiency must receive cooperation from farmers if it is to succeed. The advantages to farmers of making changes - such as increased savings, improved service, or maintenance of delivery service during the war - must be pointed out to them if their cooperation is to be assured. An educational or informational program introducing and accompanying a delivery efficiency program will greatly increase its chances of success.

Analysis of Patrons' Performance Records

Before needed changes in practices and adjustments in farm storage can be made, it is necessary to have definite information on each farmer's seasonal and annual consumption of motor fuels, his purchasing habits, and his storage capacities. For example, the Farmers Union Oil Co., Rugby, North Dakota, maintained for the use of the manager and the truck operators a special record of each patron's daily purchases. In the office were kept loose-leaf note books containing one sheet for each patron on which were recorded dates and gallons of each purchase of each type of motor fuel for the entire year. Different colored pencils were used for recording different types of fuel. Form 4 is a slightly revised illustration of the form used by this association.

Such records show at a glance each farmer's seasonal and annual purchases, and the size and frequency of individual purchases. When insufficient orders are on hand for a full load to a community, such records are helpful in determining which other farmers in the same community would be likely to need fuel. Furthermore, they are helpful in planning daily routes based upon advance orders. They are also of assistance to new truck operators in becoming acquainted with the petroleum needs of the patrons. A large county map in the office plus the information on each patron's sheet regarding his location enabled new employees to quickly learn the shortest routes to patrons' farms.

These daily purchase records also aided the management in determining the storage capacity needed on various farms, and the number of farmers on regular, weekly routes that were buying fuels only twice a month. Frequently deliveries could be changed from a weekly basis to a semi-monthly basis without lowering the standard of service. Information obtained through use and analysis of patrons' performance records can aid in planning efficient distribution of motor fuels to farms not only during but after the war.

Daily Records of Delivery Operations and Costs

Only by means of accurate, detailed performance records on tank trucks can the results of changes in delivery practices and equipment be measured. Daily records should be kept on deliveries of each type of motor fuel and on the mileage driven by each truck to make possible the computation of "gallons delivered per mile of travel" for any period. This is a simple measure of delivery efficiency that can be used in determining the degree of internal improvement each year. Its use in comparing delivery efficiency between associations is limited to those with similar delivery equipment and farm storage, and to those operating in areas similar as to size, density of patrons, and topographical features.

In computing "gallons delivered per mile," fractional units should not be disregarded. For instance, an increase from 11.5 to 15.0 gallons delivered per mile is 30.4 percent, or over 5 percent more than where the increase is from 12.0 to 15.0 gallons per mile, or 25 percent.

When a truck normally delivering 10 "gallons per mile of travel" increases its volume 25 percent, the increase in gallons per mile is from 10.0 to 12.5, or 25 percent. If mileage is reduced 25 percent and the same volume delivered, the increase is from 10.0 to 13.3, or 33 percent. Furthermore, if one-fourth more volume is delivered on one-fourth less mileage, efficiency is improved 66.6 percent.

The "percentage of fuel hauled that is delivered" might well supplement other delivery records. It would help indicate the extent to which advance orders had been accumulated for full loads of fuel before starting deliveries.

Daily records of operating costs for each truck, when used with the above volume and mileage records, will permit the computation of truck costs per mile and per gallon. Also, mileage per gallon of gasoline can be checked regularly on each truck. Furthermore, when salaries of operators are added to truck operating costs, total delivery costs per gallon and per mile can be ascertained. If operators are on a commission basis, deducting truck costs from gross commissions will show their net incomes. Such information is useful to the management of the cooperative in determining whether its truck operators are receiving adequate or reasonable pay for their services and responsibilities.

Cooperative oil associations engaged primarily in delivering motor fuels to farms should have detailed data on delivery operations and expenses, regardless of whether the trucks are owned by the association, the manager, or the truck operators. Besides providing a means of measuring performance, such data are useful in maintenance of trucks. Cooperative oil transport associations have found it worthwhile to analyze income and expense items per gallon and per mile. Suggested forms on which to keep and analyze daily and monthly delivery and truck operating cost records will be found at the end of this report (see forms 1, 2, and 3). Records of farm deliveries are to be kept separate from those to service stations. It is suggested that deliveries include only light or refined motor fuels, and that any mileage not properly related to delivery operations be excluded.

While the cooperatives surveyed did not have county maps showing patrons, truck routes, and territories, these might well be used. Routes shown by means of colored string on pins indicating patrons would be helpful in keeping mileage to a minimum and in adding new patrons, especially when truck operators are changed.

Possibilities for Assistance by the Farmers Union Central Exchange

Some suggestions were made as to ways in which the cooperative wholesale could help local cooperatives improve efficiency in delivering petroleum products to farms. It was felt, however, that in general each local association would have to develop its own program.

Suggestions made by representatives of local associations were as follows:

1. Prepare and send to local cooperatives recommended forms on which to keep delivery records and maps on which to locate patrons and prospective patrons. Such forms might include daily work sheets showing gallonage delivered and mileage traveled, and analysis sheets by months. Also, forms for keeping delivery costs might be prepared separately or in combination with those suggested above.

2. Arrange for the manufacture and distribution of specified type of farm storage tank and steel platforms or stands for them which might be sold as individual or combination units.

3. Sponsor surveys or studies of delivery methods and practices used by local associations on the basis of comparable areas or States and make summaries of such studies available to local cooperatives.

4. Send out short news stories occasionally on what certain local cooperatives have done to improve efficiency - giving methods used and results.

5. Provide a fieldman for the servicing or maintenance of bulk station equipment such as provided by some of the major companies. Assistance and advice could be given on reducing shrinkage, acquiring or rearranging facilities, and assisting truck operators in improving delivery methods and practices. Local companies could pay the cost of this service just as they now pay for auditing service.

6. Conduct a delivery efficiency contest among local cooperatives and their tank truck operators each year. Factors which might be considered are gallons delivered per mile of travel, percentage of fuel hauled that was delivered, total volume delivered during the year, percentage of fuel sold for cash, and number of accidents involving trucks and operators.

SUMMARY AND CONCLUSIONS

Delivery of motor fuels and other petroleum products to farmers by cooperative oil associations came under scrutiny particularly during the wartime shortages of fuels, manpower, and motorized equipment. Some of the oil associations had always stressed economical delivery practices and conservation of trucks, but all were eager to find new ways of cutting mileage and stretching service and manpower. To assist in making available information on efficient practices, the Cooperative Research and Service Division studied the experiences of 21 local cooperative oil associations affiliated with the Farmers Union Central Exchange, St. Paul, Minnesota. These were located in Wisconsin, Minnesota, North and South Dakota, and Montana.

1. Records on a limited number of tank trucks indicated that delivery efficiency had been improved at least 25 percent in terms of "gallons delivered per mile driven" since the beginning of the war. One in 1943 showed an increase of 37 percent and two showed 50 percent increases over 1942.

2. Delivery records on 31 tank trucks for 8 months or more in 1943 showed a range in "gallons delivered per mile driven" from 5.9 to 20.6. One-fourth delivered less than 11.0; one-fourth exceeded 16.5; and the average was 13.5 gallons delivered per mile. Comparable data for previous years were not available on most trucks. Operating costs of 6 trucks averaged approximately 0.5 cents per gallon and 5 cents per mile. Total delivery costs varied from 1.0 to 1.5 cents per gallon and from 12 to 15 cents per mile depending upon salaries paid to truck operators.

3. Comparisons in efficiency could not be made between the 16 cooperatives delivering all their farm volume in response to "orders" and the 3 operating on regular, scheduled routes because of the small sample, but wide variations in truck performances under each system indicated that delivery practices, equipment, farm storage, and other factors were more important than the system used. Managers generally believed that regular routes should be limited to areas with a high density of mechanized farms and with little seasonal variation in consumption of petroleum products.

4. Tank truck operators took much better care of their trucks after the war began. Operators of the 52 regular tank trucks employed by the associations drove slower and more carefully, checked tires and mechanical parts more frequently, and made repairs earlier to avoid serious trouble. Two associations maintained their own repair shops and one kept two extra motors reconditioned for emergency use.

5. Trucks equipped with tanks over 600 gallons in capacity delivered about 12½ percent more fuel per mile of travel in 1943 than those with tanks under 600 gallons in capacity. Managers and truck operators in the rougher sections of Wisconsin usually recommended 600-gallon tanks while those in the Dakotas recommended 800-gallon tanks. A few in level areas of heavy tractor farming believed that 900- to 1,000-gallon tanks could be used if farm storage and other factors were adjusted toward improvement of efficiency.

Managers and truck operators believed that efficiency could be improved by fitting tank trucks with mechanical unloading equipment and meters. In 1943, 71 percent of the regular tank trucks were equipped with hand, power take-off, or gasoline-engine unloading pumps. Truck operators agreed that such equipment saved considerable time and manpower as compared to hand unloading by cans and was especially desirable for filling overhead farm storage tanks. Only seven trucks had meter equipment, but meters had been ordered for six additional trucks.

Delivery trips to a farm can be kept to a minimum only if there is adequate storage space on the farm in relation to its seasonal needs. Cooperatives have encouraged farmers to enlarge their petroleum storage capacity. Some western associations reported that one-half to two-thirds of the farms now had large tanks ranging from 250 to 500 gallons in capacity. However, wartime scarcity and restrictions regarding used or new tanks and drums has caused trucks to make many extra trips to farms.

Redistribution of barrels among farmers by truck operators aided in meeting storage shortages. When a farmer acquired a large tank, his extra drums were placed among other farmers most in need of them. Winter fuel oil patrons were encouraged to loan their barrels to spring and summer gasoline users, and vice versa.

One of the most helpful efforts to improve efficiency by cooperatives delivering fuel "on orders" was to have farmers give longer notices of their motor fuel needs. Many patrons, in 1943, were ordering fuel 24 to 48 hours in advance instead of 12 hours or less before the war. On the basis of such advance orders, truck operators have been able to plan daily routes so as to dispose of an entire load of fuel with the least possible mileage.

"Standing orders" among farmers helped most truck operators to dispose of all the fuel in a load before returning to the bulk station. Also, large farmers in certain localities, outlying service stations, and dealer-agents, could be used as "dumping stations" for extra fuel remaining on trucks.

Larger drops or fills and minimum-order requirements helped to improve delivery efficiency. Farmers cooperated by placing orders to fill their storage facilities. Some associations increased minimum deliveries from 25 gallons to 50 or 100 gallons, but compliance with such standards was limited by lack of storage capacity on many farms.

Lengthening intervals for covering "regular, scheduled routes" from a week to 2 weeks or more aided in the conservation of equipment. Further progress in this respect should be possible when farm storage capacities can be increased.

Truck operators had reduced mileage since the war by discontinuing special deliveries, solicitation of business, collection work with trucks, and call-backs for deliveries or to collect rationing coupons. Most operators had about all the business they could handle, but the importance of delivering a large volume in a compact area indicates that efficiency can be improved by getting additional patrons on routes or in communities already being served. Several cooperative representatives expressed a desire to reduce the number of grades of fuel handled, as frequently they had orders for more fuels than there were compartments in the tank truck.

Improvements in delivery efficiency depended more upon the adoption of a definite efficiency program supported by educational work with farmers

than upon local operating and agricultural conditions affecting petroleum deliveries. The close correlation between volume delivered and efficiency and the variation in delivery records of trucks within the same association indicated that all cooperatives have within their control the means of improving efficiency. The advantages to farmers of making changes in practices and equipment, such as increased savings, improved service, or maintenance of delivery service, must be pointed out to them if full cooperation is to be received.

Analysis of the patrons' performance records with respect to their seasonal and annual consumption of motor fuels and of their purchasing habits is necessary, as well as data on farm storage facilities to determine needed adjustments in storage capacity, whether routes can be covered less frequently, or whether deliveries made "on order" can be enlarged and made at longer intervals. It is only by means of such records that the effects of changes in practices or equipment can be measured and truck performances evaluated. County maps showing location of patrons, territories, and truck routes should be helpful in keeping mileage to a minimum.

Cooperatives included in this study believed that their wholesale, the Farmers Union Central Exchange, could provide assistance in the improvement of local delivery efficiency and in conservation of equipment. They suggested that it provide delivery record forms, publish news articles on improvements in efficiency, arrange for the manufacture and distribution of more storage equipment, sponsor studies of delivery systems and practices by areas, and sponsor delivery efficiency contests.

This study of cooperative oil associations, from Wisconsin to Montana, indicated a need for further study of delivery systems and practices by separate States or by types of farming regions. There is special need for more study of "route" and "order" systems in Wisconsin, where both are in use. Further data on the merits and the costs of farmers hauling their own fuel in Montana would be of interest.

Many possibilities exist for the improvement of delivery efficiency among petroleum cooperatives in the North Central States. Should gross margins decline in the future, cooperatives will find it necessary to operate more efficiently to show operating savings. Economies in the delivery of motor fuel can play an important role in such a program.

SUGGESTED DELIVERY EFFICIENCY RECORD FORMS

Form 1. - Daily Tank Truck Delivery and Operating Cost Records

Association _____ Address _____

Operator _____ Week ending _____ 1944

Truck number _____ Make _____ Capacity of tank _____

DAILY DELIVERY RECORD

Day	Speedometer reading		Miles driven[1]			Gallons delivered[1]			Total gallons hauled	Number of	
	Morning	Evening	To farms	To stations	Total	To farms	To stations	Total		Calls	Sales
Sunday											
Monday											
Tuesday											
Wednesday											
Thursday											
Friday											
Saturday											
Total											

(a) Miles driven during week: Business _____ Personal _____ Total _____

(b) Gallons of oil delivered during week _____ Pounds of grease _____ Other mdse. sold $ _____

[1] Exclude mileage not related to deliveries. Include only light, refined motor fuels.

DAILY TRUCK OPERATING COST RECORD

Day	Gasoline		Oil		All other truck expense*		Total expenses
	Gallons	Amount	Quarts	Amount	Explanation	Amount	
Sunday							
Monday							
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							
Total							

*Include tires, tubes, grease, anti-freeze, repairs and labor charges, insurance, licenses, etc.

Form 2. - Summary and Analysis of Truck Delivery Records

_____ Assn.

_____

For year ending _____, 1944

Truck operator _____ Truck no. _____
Make of truck _____ Year _____ Rated capacity _____ Type _____
Size of truck tank _____ Number of compartments _____
Pump: Gasoline, power take-off, or hand _____ Meter? _____
Deliveries made on routes or orders? _____ Size of truck's territory: N_ S_ E_ W_
Percent of all farm volume in above territory delivered by this truck (est.) _____

SUMMARY OF DELIVERY RECORDS

1944 Month	Miles driven			Gallons delivered			Total gallons hauled	Number of	
	To farms	To stations	Total	To farms	To stations	Total		Calls	Sales
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									
Total									

(a) Gallons of oil delivered during year _____. Pounds of grease _____.
Other merchandise sold $ _____ (b) Mileage driven during year:
Business _____ Personal _____ Total _____.

ANALYSIS OF DELIVERY RECORDS

1944 Month	Gallons delivered per mile driven			Gallons delivered as a percentage of gallons hauled	Mileage per gallon of gas used
	To farms	To stations	Total		
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Total					

Form 3. - Summary and Analysis of Truck Operating and Delivery Costs

_____ Assn.

For year ending _____, 1944

Truck operator _____ truck no. _____
Make of truck _____ Year _____ Rated capacity _____ Type _____
Size of truck tank _____ Number of compartments _____

SUMMARY AND ANALYSIS OF TRUCK OPERATING AND DELIVERY COSTS

1944 Month	Gasoline		Oil		Other expense	Total expenses		
	Gallons	Amount	Gallons	Amount		Amount	Per gallon	Per mile
January								
February								
March								
April								
May								
June								
July								
August								
September								
October								
November								
December								
Total								

(1) Add depreciation for the year _____
(2) Total truck operating cost _____
(3) Costs of operator for the year: social security tax, insurance, bond, etc. _____
(4) Total delivery costs exclusive of salary or commissions _____
(5) Salary of operator _____
(6) Total delivery costs if operator is on salary _____
(7) Total gross commissions earned by truck operator, if employed on such a basis[1] _____

[1]By deducting total delivery costs of the truck operator (see No. 4 above), his net income from commissions can be ascertained. This form will, therefore, provide comparable data for operators employed either on a salary or a commission basis.

Form 4. - Individual Patron's Purchase Record for 1943

Name _____ Twp. no. _____ Sec. no. _____ Gas license no. _____
Tractors - kind and size _____ Trucks _____ Crop acres farmed _____
Annual requirement: Gas _____ Kerosene _____ Distillate _____ Other _____ Total _____
Oil _____ Grease _____ 24 hour requirement _____ Number days to return _____
Capacity of farm storage: Gas _____ Kerosene _____ Distillate _____ Other _____ Total _____

(Record gasoline in black; kerosene in green; and distillate in red)

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1													1
2													2
3													3
4													4
5													5
6													6
7													7
8													8
9													9
10													10
22													22
23													23
24													24
25													25
26													26
27													27
28													28
29													29
30													30
31													31
Total													

Remarks _____

Table 6. - Farms, farm land, crop land, roads bounding farms, and telephones on farms in specified counties of five States in 1940[1]

County	Total farms Apr. 1, 1940	Average size of farm	Farms per square mile	Farm land as a percentage of all land	Crop land in 1939 as a percentage of all land[2]	Hard surfaced and gravel roads[3]	Farms having telephones
Wisconsin:	Number	Acres	Number		Percent		
Juneau[4]	2,122	141	2.7	59	23	72	29
(Vernon)	3,979	123	4.9	95	34	93	43
Rusk	2,430	110	2.7	46	13	61	10
Barron	4,317	110	5.0	86	37	58	36
Chippewa	3,823	131	3.7	76	32	66	25
Dunn	3,354	148	3.9	91	42	52	34
Pierce	2,810	124	4.8	92	48	72	45
Minnesota:							
Renville	3,095	197	3.2	97	75	92	43
Polk	4,342	261	2.2	88	62	52	45
South Dakota:							
McCook	1,411	252	2.4	96	71	65	47
Roberts	2,279	270	2.1	86	63	52	29
North Dakota:							
Cass	2,592	422	1.5	98	82	45	26
Pierce	1,137	529	1.1	89	63	23	23
McHenry[4]	1,992	518	1.1	85	54	38	27
(Sheridan)	1,018	532	1.0	85	49	29	29
Mercer	1,057	595	1.0	90	37	27	25
Ward	2,447	454	1.2	85	56	46	26
Williams	2,080	494	1.0	77	45	27	24
Hettinger	1,055	652	0.9	95	59	20	42
Stark	1,320	625	1.0	98	52	21	27
Montana:							
Dawson	834	1,131	0.4	63	18	31	18
Richland	1,218	740	0.6	68	24	27	16
Roosevelt[4]	1,043	768	0.4	53	28	25	16
(McCone)	754	1,343	0.3	60	16	12	12

[1] Data obtained from 1940 U. S. Census of Agriculture.
[2] Crop land includes crop land harvested, crop failure, and crop land idle or fallow. Plowable pasture was not included.
[3] Many farms have frontage on more than one type of road. In such cases they were classified according to the highest or superior type of road recorded for them.
[4] Cooperative is located near county line, and its trade territory extends into county indicated by parentheses.

Table 7. - Tractors, trucks, automobiles, and value of machinery and implements, April 1, 1940, and expenditures for gasoline, kerosene, distillate, and oil per farm during 1939, in selected counties in five States[1].

County	Tractors				Trucks per 100 farms	Automobiles per 100 farms	Farm expenditures for gasoline, kerosene, distillate, and oil in 1939[2]		Average value of machinery and implements per farm
	Total	Per 100 farms	Per square mile	Per 1,000 acres of crop land			Per farm	Per square mile	
	Number						Dollars		
Wisconsin:									
Juneau[3]	609	28.6	0.8	5.3	13	96	69	141	902
(Vernon)	1,125	28.3	1.4	6.4	18	108	74	270	776
Rusk	548	22.6	0.6	7.3	14	82	57	112	548
Barron	1,522	35.3	1.8	7.4	18	91	72	250	743
Chippewa	1,193	31.2	1.2	5.8	23	96	84	267	804
Dunn	1,278	38.1	1.5	5.6	18	106	84	256	928
Pierce	1,150	40.9	1.9	6.3	14	103	81	309	956
Minnesota:									
Renville	2,736	88.4	2.8	5.8	28	126	211	618	1,892
Polk	2,985	48.7	1.5	3.8	29	101	204	383	1,302
South Dakota:									
McCook	850	60.2	1.5	3.2	11	103	127	253	935
Roberts	1,291	56.6	1.2	2.9	19	105	150	236	993
North Dakota:									
Cass	2,534	97.8	1.4	2.8	47	110	309	399	1,901
Pierce	671	59.9	0.6	1.6	31	103	200	170	1,197
McHenry[3]	1,051	52.8	0.6	1.6	26	97	158	130	952
(Sheridan)	520	51.1	0.5	1.7	22	100	122	106	848
Mercer	594	56.2	0.5	2.3	22	97	121	109	771
Ward	1,489	60.8	0.7	2.0	32	90	191	178	957
Williams	1,290	62.0	0.6	2.1	29	82	167	129	948
Hettinger	764	72.4	0.7	1.8	42	90	211	172	1,109
Stark	960	72.7	0.7	2.2	39	99	195	177	1,160
Montana:									
Dawson	498	59.7	0.2	1.8	44	86	202	60	925
Richland	915	75.1	0.4	2.9	56	84	223	110	1,172
Roosevelt[3]	780	74.8	0.3	1.8	53	74	272	92	1,315
(McCone)	483	64.1	0.2	1.8	48	83	195	47	877

[1] Data obtained from 1940 U.S. Census of Agriculture.
[2] The number of farms reporting such expenditures averaged 81 percent of all farms in the counties.
[3] Cooperative is located near county line and its trade territory extends into county indicated by parentheses.